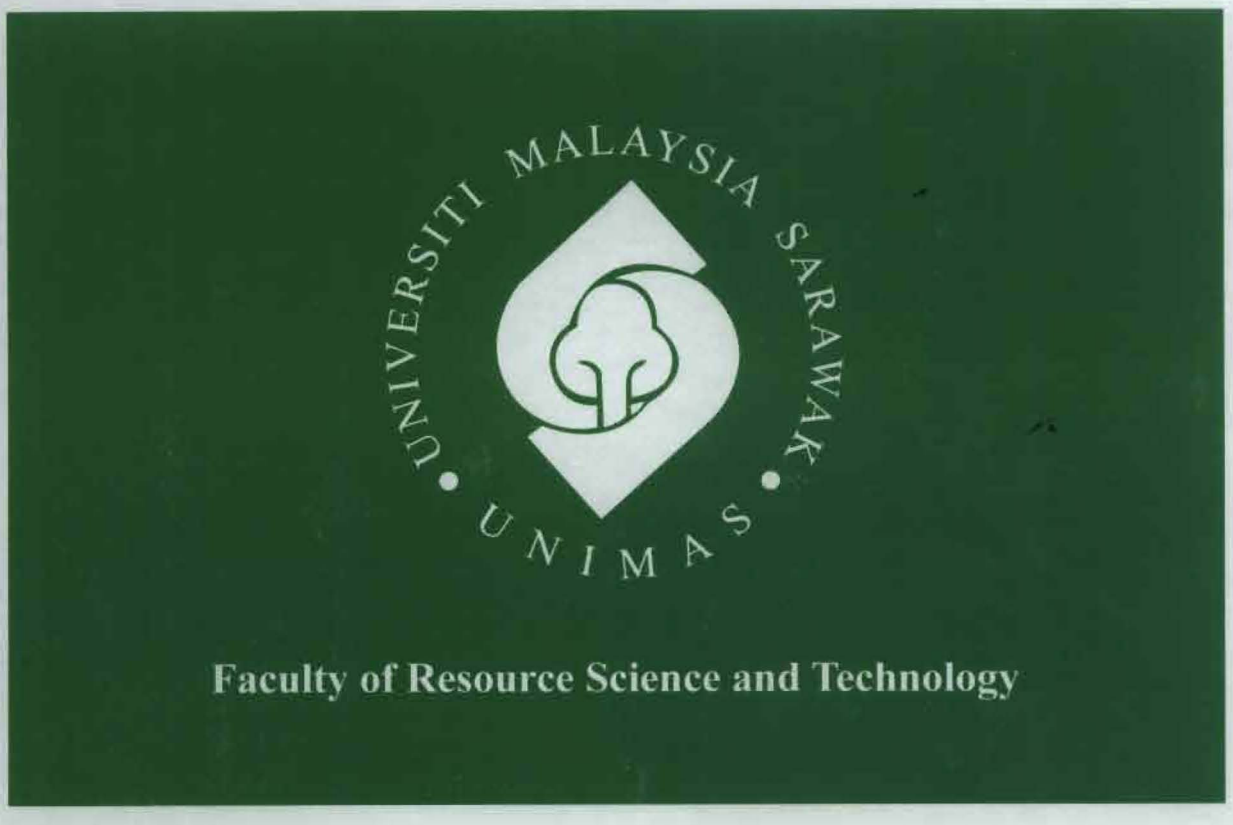

Population Estimation of Proboscis Monkey (*Nasalis larvatus*) in Sarawak, Malaysia

Ahmad Fitri bin Aziz

Master of Science
2019

UNIVERSITI MALAYSIA SARAWAK

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Final Year Project Report ☐

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PhD ☐

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Population Estimation of Proboscis Monkey (*Nasalis larvatus*) in Sarawak, Malaysia

Ahmad Fitri bin Aziz

A thesis submitted
In fulfilment of the requirement for the degree of Master of Science
(Statistical Ecology)

Faculty of Resource Science and Technology
UNIVERSITI MALAYSIASARAWAK
2019

DECLARATION

I hereby declare that this dissertation is entirely my original work except for quotations and citations which have been dully acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted in candidature for any other degree.

Ahmad Fitri Aziz

Faculty of Resource Science and Technology

UNIVERSITI MALAYSIA SARAWAK

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ABSTRACT

A central practical problem in ecology is the estimation of population size. Last published report on the state-wide survey and population estimation of proboscis monkey (*Nasalis larvatus*) in Sarawak was in 1987. In this study, survey on proboscis monkey population has been conducted at eight selected sites in Sarawak to update the estimation of population size and density of this species. This study have successfully estimated the overall population based on the forest types surveyed which had not been taken into account in any previous studies of proboscis monkey before. Boat survey technique was applied in all survey sites except in Bako National Park within a period of 17 months, starting from April 2015 until August 2016. A cumulative total of 618.6 km of riverbank and 24.14 km of line transect was surveyed. Out of eight surveyed sites, two sites show no presence of proboscis monkey which were Ulu Sebuyau National Park and Rajang Mangrove National Park. A cumulative total of 860 individuals of proboscis monkey comprising of 105 groups was sighted from all surveyed sites. Three types of forests were identified from the eight surveyed sites where the proboscis monkeys were recorded which were mangrove forest, peat swamp forest and tropical heath forest with a sighted distribution of 527, 170 and 163 individuals, respectively. The total population estimation of proboscis monkey in all surveyed sites is 838 individuals. Maludam National Park recorded the highest population estimation with 432 individuals. This was followed by Bako National Park, Samunsam Wildlife Sanctuary, Kuching Wetland National Park, Kuala Lawas Forest Reserve and Limbang Mangrove National Park with estimated population size of 105, 98, 82, 77 and 44 individuals, respectively. The overall population estimation of proboscis monkey in Sarawak based on the data from three types of forests

surveyed was 9,778 individuals. In mangrove forest, the population of proboscis monkey was estimated to be 1,981 individuals with estimated population density of 1.25 individuals/km^2. In peat swamp forest, the population was estimated to be in the number of 6,174 individuals with estimated population density of 0.96 individuals/km^2. While in tropical heath forest, the population was estimated to be 1,623 individuals with 2.76 individuals/km^2 of estimated population density. There was no significant difference between the population density of proboscis monkeys and the forest types ($F = 0.607$, $df = 2$, $P = 0.568$). In addition, the population sizes of proboscis monkeys in different forest types also did not show any significant difference ($P = 0.353$). A comparisons of population estimates from different studies is complicated by their different method of analyses. A standard method of analysis, in lieu of using forest types in the estimation is needed, so that the population estimates and the changes in the population size of the proboscis monkeys can be systematically compared and monitored in the future.

Keywords: Sarawak, proboscis monkey, estimation, population size, population density.

Anggaran Populasi Monyet Belanda* (Nasalis larvatus*) di Sarawak, Malaysia

ABSTRAK

*Masalah praktikal utama dalam ekologi ialah anggaran saiz populasi. Laporan terakhir yang diterbitkan mengenai survei negeri dan anggaran populasi monyet belanda (*Nasalis larvatus*) di Sarawak adalah pada tahun 1987. Dalam kajian ini, survei tentang populasi monyet balanda telah dijalankan di lapan tapak terpilih di Sarawak untuk mengemaskini anggaran saiz populasi dan kepadatan populasi spesis ini. Kajian ini telah berjaya menganggarkan populasi keseluruhan berdasarkan jenis hutan yang disurvei yang tidak diambil kira dalam kajian monyet belanda sebelumnya. Teknik bot survei telah digunapakai di semua tapak survei kecuali di Taman Negara Bako dalam tempoh 17 bulan, bermula dari April 2015 hingga Ogos 2016. Sejumlah kumulatif 618.6 km tebing sungai dan 24.14 km transek talian telah disurvei. Daripada lapan tapak yang disurvei, dua tapak menunjukkan tiada kehadiran monyet belanda iaitu Taman Negara Ulu Sebuyau dan Taman Negara Paya Bakau Rajang. Jumlah kumulatif monyet balanda yang dilihat adalah 860 individu terdiri daripada 105 kumpulan daripada semua tapak yang disurvei. Tiga jenis hutan telah dikenalpasti dari semua tapak yang disurvei di mana monyet belanda direkodkan iaitu hutan paya bakau, hutan paya gambut dan hutan kerangas dengan pengedaran sebanyak 527, 170 dan 163 individu, masing-masing. Jumlah anggaran populasi monyet belanda di semua tapak yang disurvei adalah 838 individu. Taman Negara Maludam mencatatkan anggaran populasi tertinggi dengan 432 individu diikuti Taman Negara Bako, Santuari Hidupan Liar Samunsam, Taman Negara Wetland Kuching, Hutan Simpan Kuala Lawas dan Taman Negara Paya Bakau Limbang dengan*

anggaran populasi 105, 98, 82, 77 dan 44 individu, masing-masing. Anggaran keseluruhan populasi monyet belanda di Sarawak berdasarkan data dari tiga jenis hutan yang disurvei adalah 9,778 individu. Di hutan paya bakau, populasi monyet belanda dianggarkan 1,981 individu dengan anggaran kepadatan populasi 1.25 individu/km^2. Di hutan paya gambut, populasi dianggarkan berjumlah 6,174 individu dengan kepadatan populasi 0.96 individu/km^2. Sementara di hutan kerangas, populasi dianggarkan 1,623 individu dengan kepadatan populasi 2.76 individu/km^2. Tiada perbezaan yang signifikan antara kepadatan populasi monyet belanda dan jenis hutan ($F = 0.607$, $dk = 2$, $P = 0.568$). Di samping itu, saiz population monyet belanda di jenis hutan yang berbeza juga tidak menunjukkan perbezaan yang signifikan ($P = 0.353$). Perbandingan anggaran populasi monyet belanda dari kajian yang berlainan penuh dengan komplikasi disebabkan perbezaan kaedah analisis. Satu kaedah analisis yang standart, sebagai ganti dengan menggunakan jenis hutan dalam anggaran populasi diperlukan, supaya anggaran populasi dan perubahan saiz populasi monyet belanda dapat dibandingkan dan dipantau secara sistematik pada masa akan datang.

Kata kunci: *Sarawak, monyet belanda, anggaran, saiz populasi, kepadatan populasi.*

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LIST OF ABBREVIATIONS

BNP	Bako National Park
ca.	Circa
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
groups/km	Groups per kilometre
groups/km^2	Groups per squared kilometre
Ha	Hectare
individuals/km	Individuals per kilometre
individuals/km^2	Individuals per square kilometre
IUCN	International Union for Conservation of Nature
Kg	Kilogram
Km	Kilometre
km^2	Square kilometre
KLFR	Kuala Lawas Forest Reserve
KWNP	Kuching Wetland National Park
LMNP	Limbang Mangrove National Park
MF	Mangrove forest
MNP	Maludam National Park
PSF	Peat swamp forest
PVA	Population Viability Analysis
RMNP	Rajang Mangrove National Park
SWS	Samunsam Wildlife Sanctuary
THF	Tropical heath forest
USNP	Ulu Sebuyau National Park

CHAPTER 1

INTRODUCTION

1.1 General Introduction

Endemic to the island of Borneo, proboscis monkey (*Nasalis larvatus*) is a large and sexually dimorphic primate from subfamily Colobinae (Bennett and Gombek, 1993). There is no fossil evidence showing proboscis monkey had occurred elsewhere other than in Borneo (Harcourt and Schwartz, 2001; Harrison *et al.*, 2006; Payne and Francis, 2007). Proboscis monkey is distinctive from other primates due its large, red and protruding nose. Within the subfamily Colobinae, proboscis monkey is categorised into the odd nosed monkey group where, none possess similar trait with proboscis monkey (Bennett and Gombek, 1993). They are known to be the largest colobine monkey and the sole member from the genus *Nasalis* (Napier and Napier, 1967; Medway, 1977; Wolfheim, 1983).

The natural habitats of proboscis monkey are restricted to the lowland coastal rainforests including mangroves, riverine, peat and fresh water swamp forest that is always associated with waterways (Kawabe and Mano, 1972; Salter *et al.*, 1985; Bennett and Gombek, 1993; Meijaard and Nijman, 2000). Mangrove trees are the main features in the habitat where the trees are used for resting and sleeping, while the leaves serve as their food (Kawabe and Mano, 1972). During the day, it will forage inland normally less than 1 km away from the riverbank and always return before dusk to sleep (Salter *et al.*, 1985; Bennett and Sebastian, 1988; Yeager, 1989; Matsuda *et. al.*, 2008). Proboscis monkey has their own flexible social structure, for instance one-male with multi-female groups or all-male groups

(Bennett and Sebastian, 1988). Within several groups, a secondary level of social organisation may occur where they may travel and sleep together in close proximity (Boonratana, 2002).

The proboscis monkey is protected by law throughout its range. In Sarawak, proboscis monkey is classified as a totally protected species under the Sarawak Wildlife Protection Ordinance 1988. This primate is classified as endangered in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (IUCN, 2017). In the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), this animal is listed in Appendix I. In the year of 2000, the status of this primate was changed from 'vulnerable' to 'endangered' (Meijaard *et al.*, 2008). The combination of hunting, degradation of their habitats by the cause of logging and conversion into agricultural land were identified as the major impact of the declining population of this primate (Meijaard and Nijman, 2000).

In Kalimantan, Indonesia, there are huge differences on the estimations of population size of proboscis monkey. Based on the estimation by MacKinnon (1987), there are more than 250,000 individuals of proboscis monkey within Kalimantan and ca. 25,000 of them are live in protected areas. Yeager and Blondal (1992) suggested that there are less than 5,000 individuals of proboscis monkey reserve in the protected area. Manansang *et al.* (2005) however suggested that the population of proboscis monkey in the Central, West and East Kalimantan was 9,200 individuals. Proboscis monkey population in Kalimantan found to be more widely distributed compared to other regions in Borneo (Meijaard and Nijman, 2000).

In Sabah, based on the state-wide survey of proboscis monkey, the population were estimated to be at least 2,000 individuals (Davies and Payne, 1982). A more recent survey conducted by Sha *et al.* (2008) found that the population was higher than that of recorded previously. The minimum of proboscis monkey population in Sabah were thought to be 5,907 individuals. Population of proboscis monkey in Sabah were found to be highly fragmented with only five major centres of continuous distribution and numerous small isolated populations along the major coastal river of Sabah including Klias Peninsula, Tankarason, Paitan, Sugut, Beluran, Sandakan, Kinabatangan, Segama River, Lahad Datu, Semporna Peninsula and Tawau Bay.

In contrast, the population of proboscis monkey in Sarawak was estimated to be less than 2,000 individuals (Salter and MacKenzie, 1985). A survey by Bennett *et al.* (1987) estimated that the population of proboscis monkey in Sarawak was less than 1,000 individuals. The distributions of proboscis monkey in Sarawak were widely distributed with a huge fragmentation, concentrated at the western part of the state (Salter and MacKenzie, 1985). In Brunei, the population size of proboscis monkey in Brunei Bay was estimated to be less than 300 individuals (Bennett, 1986). However, the population in Brunei Bay is homogenous with the population in Sarawak since it is located between the two divisions of Sarawak, which are Limbang and Lawas. The exact population of proboscis monkey in Brunei Bay were difficult to determine since they are known crossing into Sarawak.

1.2 Problem Statement

There are only a few localities where proboscis monkey are known to occur in Sarawak including Bako National Park, Kuching Wetland National Park, Samunsam Wildlife Sanctuary, Maludam National Park, Limbang Mangrove National Park and Kuala Lawas Forest Reserve. Based on previous studies of proboscis monkey in Sarawak, most were focused on their behaviour and ecology (Salter *et al.*, 1985; Bennett and Sebastian, 1988; Onuma, 2002; Tuen and Pandong, 2007; Pang *et al.*, 2007; Matsuda *et al.*, 2008; Kombi and Abdullah, 2013). Only a few studies have been conducted to estimates their population. Moreover, the estimations were always conducted in localities where proboscis monkey are well established, such as in Bako National Park and Samunsam Wildlife Sanctuary (Brundell *et al.*, 1990; Zaini *et. al.*, 2004; Tuen and Pandong, 2007). A central practical problem in ecology is the estimation of population size (Krebs, 1989). However, this basic information has been ignored in the past, even though the population of proboscis monkey are known to be declining (Chapman and Peres, 2001; Fuller *et al.*, 2004). Till presently, the status of the proboscis monkey in Sarawak still depending on previous data (Salter and MacKenzie, 1985; Bennett *et al.*, 1987). Even though these estimates are known to be out-dated, they are still being cited until today. A population and habitat viability assessment in Indonesia by Manansang *et al.* (2005) was first planned to cover the population of proboscis monkey for the entire range. However, basic data to draw up an accurate range maps and estimate population numbers were insufficient particularly for Malaysia Borneo. Without such information, it is impossible to formulate conservation plan to ensure the survival of proboscis monkey. In this study, a comprehensive and systematic state-wide survey of proboscis monkey population was

conducted in Sarawak to estimate the population density and population size. The population estimation in this study were analysed based on the type of forests where the proboscis monkey were recorded. Data of the estimation population density from each site were then extrapolated and being used as a representative data to estimate the population of proboscis monkey in each forest type surveyed. There are several assumptions need to be considered in this study. First, all the proboscis monkeys individuals have the same probability for being sighted due to the one-way of survey. Second, all proboscis monkeys individuals within 100 m radius were assumed to be in the same group. Third, the acreage of the forest types from the mapping analysis is considered to be accurate. Lastly, proboscis monkeys in Sarawak is assumed to inhabit only in mangrove, peat swamp and tropical heath forests. This study is important to provide a reliable and updated data in order to access the actual status of the current population of proboscis monkey in Sarawak.

1.3 Objectives of Study

The objectives of this study are:

i. To estimate the current population density of proboscis monkey in Sarawak.

ii. To estimate the current population size of proboscis monkey in Sarawak.

1.4 Hypothesis

H_{O1}: There is no significant difference between the population densities of proboscis monkeys in different forest types.

H_{A1}: There is significant difference between the population densities of proboscis monkey in different forest types.

H_{O2}: There is no significant difference between the population sizes of proboscis monkey in different forest types.

H_{A2}: There is significant difference between the population densities of proboscis monkey in different forest types.

CHAPTER 2

LITERATURE REVIEW

2.1 Morphology of Proboscis Monkey

In the island of Borneo, there are three political divisions, which are bounded by Malaysia (Sabah and Sarawak), Brunei and Indonesia (Kalimantan). Different communities in Borneo named proboscis monkeys differently. In Sarawak, Dayak communities call proboscis monkey as *Rasong* while Malay community calls it as *Orang Belanda* or *Monyet Belanda* (Zaini *et al.*, 2004). Communities in Sabah always known proboscis monkey as *Bayau.* While in Kalimantan, proboscis monkey are often known as *Benkantan* (Zaini *et al.*, 2004).

Proboscis monkey possess a high degree of sexual dimorphism (Bennett, 1986). Between male and female, there are several obvious differences in the morphological appearance. Adult male proboscis monkey larger than female with an average of 20-24 kg while female is lighter than the male with an average half of the male weight, which is about 10-12 kg (Bennett and Gombek, 1993; Phillipps and Phillipps, 2016). An adult male proboscis monkey can be easily identified by a large and pendulous nose. However, an adult female proboscis monkey has smaller and pointed nose. In both sexes, proboscis monkey has reddish-brown fur but male display more striking colour with much thicker, darker mane of hair across their back and have a darker cap on top of their head (Bennett and Gombek, 1993). In both sexes, proboscis monkey have a pair of webbed hind feet, which are likely to aid in swimming and walking on mangrove mud (Harding, 2015). An infant proboscis